

# Natural Hazards

*September 2022*





## Natural Hazards

*This page intentionally left blank.*

# Table of Contents

**Responses to Community Feedback on Environmental Existing Conditions Reports..... 1**

**Natural Hazards..... 2**

**Key Findings and Constraints ..... 2**

    Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) ..... 2

    Senate Bill 379..... 2

    Assembly Bill 747..... 3

    Senate Bill 99..... 3

    Alquist-Priolo Earthquake Fault Zoning Act ..... 3

    Sonoma County Community Wildfire Protection Plan ..... 3

    Petaluma General Plan..... 4

    City of Petaluma Local Hazard Mitigation Plan (LHMP)..... 4

    The Petaluma River Flood Control Project and the Payran Levee Project ..... 4

**City Role in Hazard Mitigation ..... 4**

**Natural Hazards ..... 5**

    Seismic Hazards ..... 5

    Landslides and Erosion ..... 8

**Flood Hazards and Flood Zones ..... 8**

**Wildfire Hazard..... 11**

    Wildland Urban Interface (WUI)..... 12

    Fire Protection Resources ..... 12

## Natural Hazards

*This page intentionally left blank*

# Responses to Community Feedback on Environmental Existing Conditions Reports

The following responses were drafted by the consultant team in response to extensive community feedback on topics that crosscut the seven Environmental Existing Conditions Reports.

**Trees and Urban Canopy:** Maintaining and expanding a robust urban forest is a priority for the City and will be incorporated into the updated General Plan goals, policies, and programs to further develop and maintain the urban forest and protect trees of aesthetic, cultural, and biological value to the community. The General Plan Update will capitalize on ways to build on and expand existing plans and programs through tools like tree inventories and tree preservation ordinances.

**River Enhancement Program:** The River Enhancement Plan will provide an existing foundation for goals, policies, and programs to be implemented as this plan will continue to be in effect and utilized after the General Plan Update. Throughout the General Plan Update process, this plan will be thoroughly reviewed and incorporated into the General Plan.

**Wildlife Corridors:** The information regarding the wildlife corridors discussion were a compiling of local resources that can be used to understand the stakeholders that the City can partner with in supporting efforts to conserve wildlife corridors, especially in support of efforts by the State, to preserve a statewide network of wildlife movement corridors. There will be opportunities in future steps of the General Plan Update process to include more detail of the wildlife corridors surrounding Petaluma using data from CDFW and other available sources.

**Climate Impacts Data:** The State of California requires local jurisdictions to use specified data sources for identified hazards such as FEMA for the flood hazards analysis and the Cal Adapt tool for climate change projections. These are the data sources used to conduct the analysis of climate and flood hazards, which will inform various aspects of the General Plan Update.

**Integration of Environmental Topics:** Environmental issues and considerations will be integrated throughout the General Plan Update process and additional information will be gathered and analyzed during future phases of the project. In particular, environmental analysis will be done during the alternatives and environmental review phases.

# Natural Hazards

*This section provides an overview of natural hazards affecting Petaluma and the surrounding area, focused on those related to earthquakes, wildfire, and flooding. The current regulatory setting for these hazards, as well as relevant City, County and regional projects and plans, are summarized to ensure that the General Plan Update aligns with and supports existing initiatives related to Petaluma’s hazards and geology.*

## Key Findings and Constraints

- The City of Petaluma is situated in a highly active seismic area and, given recent quake activity and the proclivity of the region for seismic activity, earthquake hazards will continue to be a factor for the city. Additional information on seismic hazards in the city is included in the Local Hazard Mitigation Plan.
- Petaluma surface hydrology, consisting of steep, dry terrain, with canyons and creeks convening downstream at the Bay, poses flood risks for low-lying areas in times of heavy precipitation. Specific areas of concern are those located along the back side of Industrial Avenue which have been flooded repeatedly over the years. The flood history and associated damage demonstrate a need for flood protection, control, and community education to be addressed in the General Plan Update.
- Petaluma does not have any state designated high fire hazard zones within the city limits; however, there are high fire hazard areas near to the city and extensive development in densely vegetated wildlands has increased the risk of wildfire property damage and loss of life. Risk of wildfires in the Wildland Urban Interface (WUI) are projected to increase due to the effects of climate change.

## Regulatory Setting

### Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act)

Authorizes the delivery of federal emergency technical, financial, logistical, and other assistance to states and localities. A governor must first determine that an event overwhelms the state’s capacity to respond and request a presidential declaration under the Stafford Act before the president can declare all or a portion of a state a “major disaster” or “emergency” area. The Federal Emergency Management Agency (FEMA) coordinates administration of disaster relief resources and assistance to states. The President can declare an emergency without first receiving a gubernatorial request if the emergency involves an area of federal primary responsibility such as a federal building. A Stafford Act declaration can be used to trigger other public health emergency response authorities such as Social Security Act Section 1135 waiver authorities.

### Senate Bill 379

Requires all cities and counties to include climate adaptation and resiliency strategies in the safety elements of their general plans upon the next revision beginning January 1, 2017. The bill requires the climate adaptation update to include a set of goals, policies, and objectives for their communities based

on the vulnerability assessment, as well as implementation measures, including the conservation and implementation of natural infrastructure that may be used in adaptation projects. Specifically, the bill requires that upon the next revision of a general plan or local hazard mitigation plan, the safety element is to be updated as necessary to address climate adaptation and resiliency strategies applicable to the city or county.

## **Assembly Bill 747**

Requires all cities and counties to identify evacuation routes in the safety elements of their general plans beginning January 1, 2022. The bill requires evaluation of evacuation route capacity, safety, and viability under a range of emergency scenarios. The bill allows cities or counties with an adopted local hazard mitigation plan, emergency operation plan, or other document that fulfills commensurate goals and objectives, to summarize or incorporate the information from these plans or documents in the safety element to comply with this requirement.

## **Senate Bill 99**

Requires all cities and counties, upon the next revision of the housing element on or after January 1, 2020, to update the safety element to include information identifying residential developments in hazard areas that do not have at least two emergency evacuation routes. By increasing the duties of local officials, this bill would impose a state-mandated local program.

## **Alquist-Priolo Earthquake Fault Zoning Act**

Signed into law in 1972, this legislation addresses development in areas prone to faulting. Under the Act, the State Geologist is required to delineate earthquake fault zones (also known as Alquist-Priolo zones or special study areas) along active faults in California. The act defines an active fault as one that has “had surface displacement within the Holocene epoch (approximately the last 11,000 years).” Cities and counties with Alquist-Priolo zones must regulate certain development in these zones.

## **Sonoma County Community Wildfire Protection Plan**

The goal of a CWPP is to enhance efforts to protect communities, watersheds and other at-risk lands from catastrophic wildfire. Under the requirements of the Healthy Forest Restoration Act, a CWPP must be created with extensive community collaboration, priority for fuel reduction, and recommendations for the future.

The Sonoma County Community Wildfire Protection Plan (CWPP) was developed as a collaboration with various agencies and community members, including Fire Safe Sonoma, Cal Fire, and Sonoma County. It was approved in 2016 by the Sonoma County Board of Supervisors and includes the identification of prioritized treatment areas and mitigation strategies and the recommendation of measures to reduce ignitability of structures. Since the adoption of the CWPP in 2016, wildfires have occurred at a more frequent rate. The County is currently in the process of updating their CWPP to account for new concerns related to the growing wildfire threat.



## Petaluma General Plan

This plan will build on the policies and guidance from the previous General Plan for the City. In accordance with new state and federal legislation, the General Plan will put forward policies intended to help protect the health and safety of the community.

## City of Petaluma Local Hazard Mitigation Plan (LHMP)

The purpose of a hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. The City of Petaluma developed the Local Hazard Mitigation Plan (LHMP) update to make the City and its residents less vulnerable and more resilient to future hazard events. The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 so that Petaluma would be eligible for the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation and Hazard Mitigation Grant programs. The City of Petaluma released the most recent Final LHMP in November 2020.

## City of Petaluma Floodplain Management Plan

Adopted in October 2015, this plan is an update to the existing floodplain management plan. Floodplain management plans developed in accordance with FEMA regulations and participation can save residents with flood insurance tens of thousands of dollars per year in insurance costs.

## The Petaluma River Flood Control Project and the Payran Levee Project

In response to repeated flooding along the Petaluma River and in the Payran neighborhood, the Flood Control Project and the Payran levee project are designed to lower the flood hazard potential in the Payran neighborhood which make up the lowest-lying area in the city and most prone to flooding.

## City Role in Hazard Mitigation

While the nature of natural hazards requires a coordinated mitigation and response planning effort across local, regional, and State jurisdictional lines, the City of Petaluma has several roles in planning for natural hazards specifically, including:

- **Land Use:** Through the updating of zoning and land use policies, the City Planning Division decreases hazard risk in the community and encourages future development to avoid hazardous areas.
- **Infrastructure:** The City seeks County, State, and federal funding for projects that increasing protection from natural hazards.
- **Hazard Mitigation:** The City has a Local Hazards Mitigation Plan and a Health and Safety Element that identify hazard risks and measures to mitigate damage to property and loss of life from natural hazards.
- **Emergency Response:** The City can update Emergency response policies and protocols to increase response efficiency and help ensure that Emergency Services remain available even during a natural disaster.

- **Emergency Preparation Education:** Building on existing emergency response institutions in the community, the City promotes programming and services to better prepare residents for natural hazards.

## Natural Hazards

### Seismic Hazards

#### Regional Fault Lines

The City of Petaluma is situated in a highly active seismic area and, given recent quake activity and the proclivity of the region for seismic activity, earthquake hazards will continue to be a factor for the city. The Tolay Fault resides in the northwestern portion of the city and an additional unnamed fault runs somewhat parallel to the Tolay Fault, as shown in **Figure 1**. To the southeast of the city the Lakeview fault runs to the southeast parallel to the Tolay fault that continues in this area. To the south of the city, but not in the City limits, the Burdell Mountain fault runs from west to east along the hills along part of Highway 101. The Rodgers Creek fault and Bennet Valley fault zone resides northwest of the city. Other major fault lines are present in the region, such as the San Andreas Fault and the Rodgers Creek Fault, which could cause serious ground shaking, which is discussed in the next section.

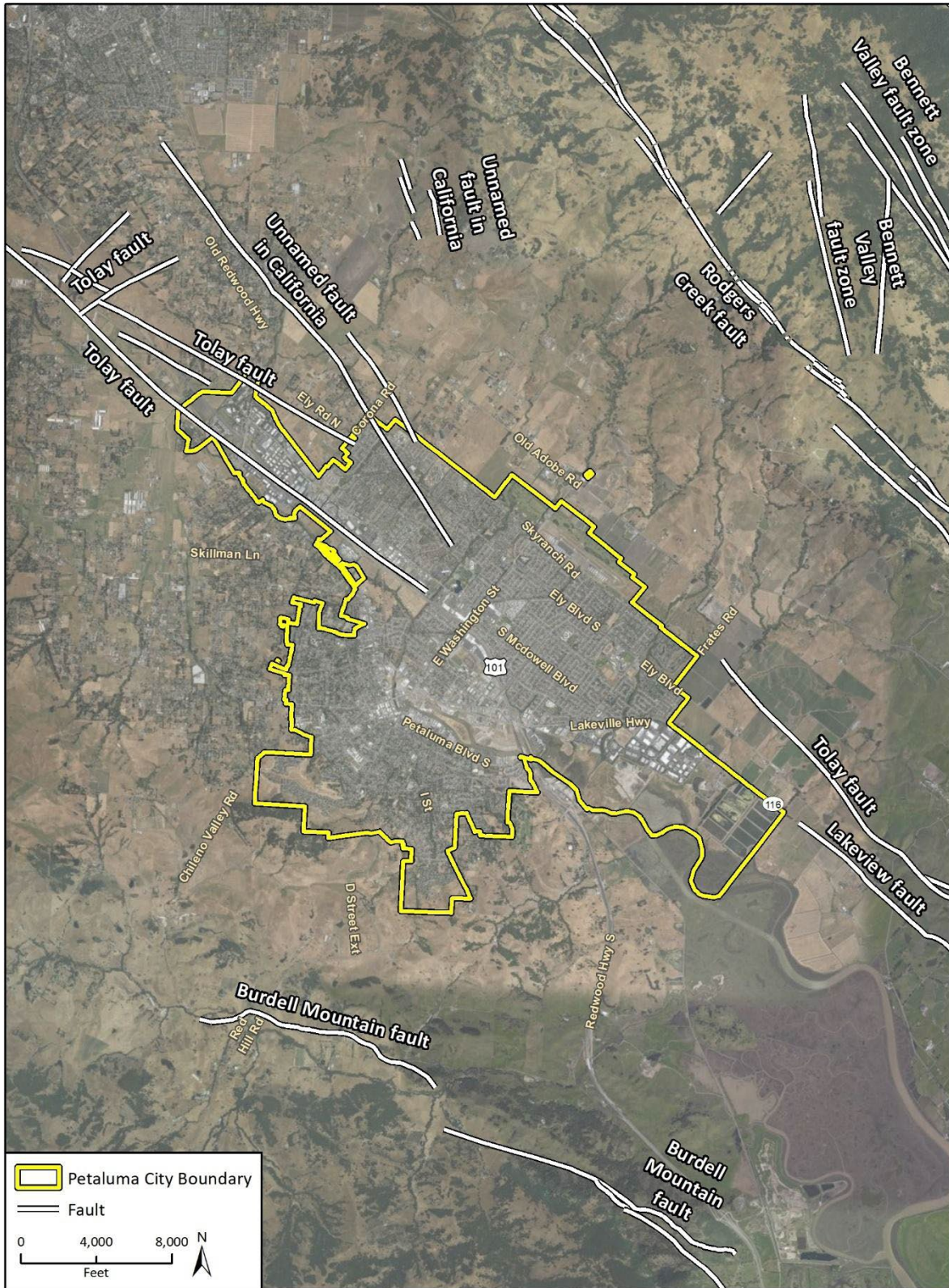
#### Ground Shaking Intensity Potential in Petaluma

The City of Petaluma is situated within an area of high potential seismic activity (the San Francisco Bay Region), and so the fault systems within and around the City have the potential to produce earthquakes that could impact the City of Petaluma significantly. A high-magnitude earthquake on one of these faults, from **Figure 1** above, could cause moderate to high ground shaking in the City. **Figure 2** is an earthquake ground shaking intensity map for the City of Petaluma that is based on the modified Mercalli Intensity Scale (MMI). The intensity of ground shaking in the map represents a worst-case shaking scenario and shows that the City of Petaluma will experience strong ground shaking. As **Figure 2** illustrates, the most intense ground shaking is likely to occur in the southeast corner and eastern perimeter of the city. Due to the seismic complexity of the region, all of Petaluma is susceptible to severe ground shaking.

#### Liquefaction Risk in Petaluma

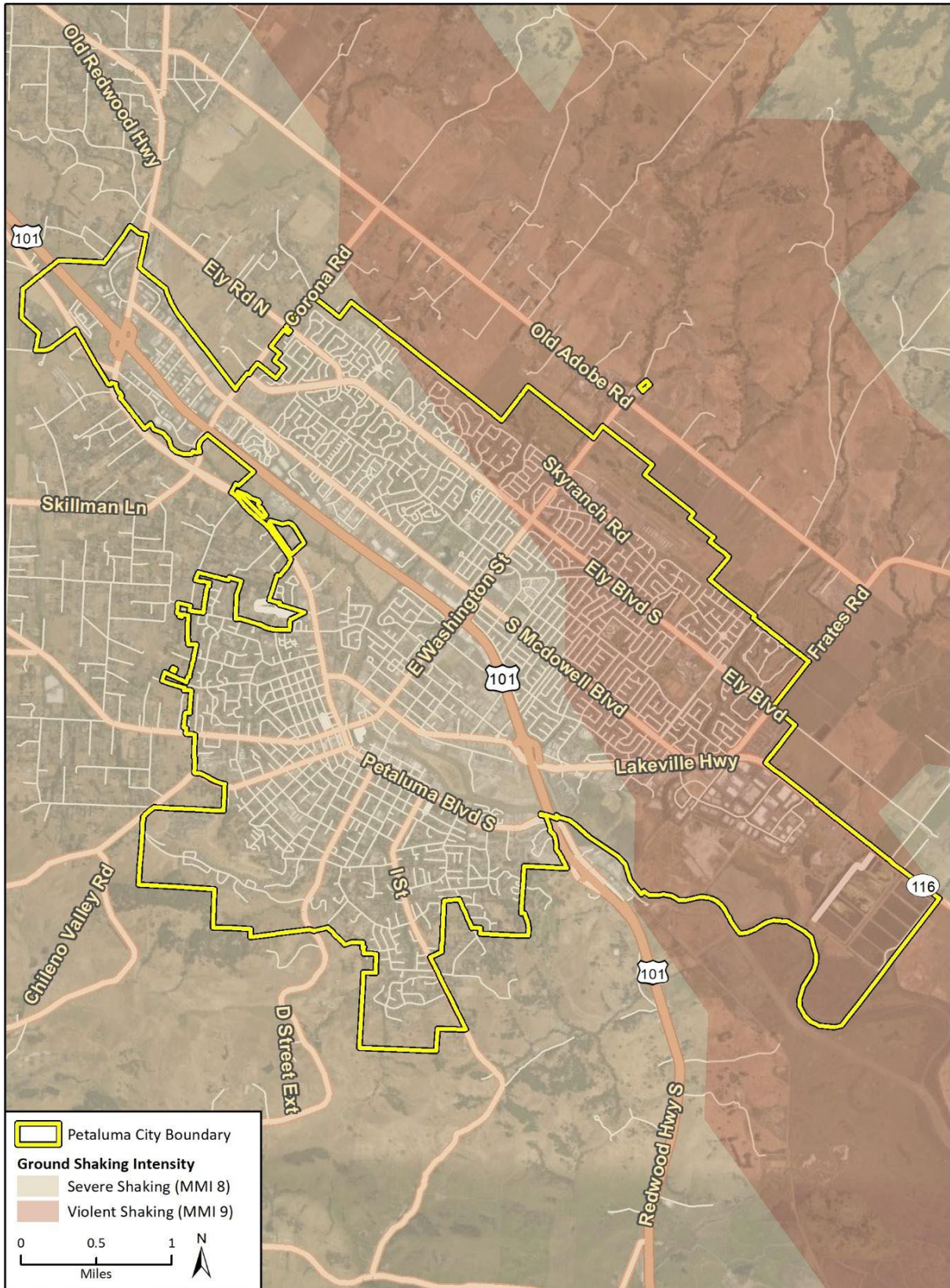
Liquefaction can be defined as the loss of soil strength or stiffness due to a buildup of pore-water pressure during a seismic event, and is associated primarily with relatively loose, saturated fine to medium-grained unconsolidated soils. In the event of an earthquake the seismic ground shaking of loose, granular soils that are saturated or submerged can cause the soils to liquify and behave as a dense fluid temporarily. Most of the city is in the moderate liquefaction risk zone, while parts of it in the center and close to Highway 101 (near Washington Street and Western Avenue) are higher risk zones. Approximately 1,851 acres are at high risk of liquefaction within Petaluma, and 559 acres are at very

**Figure 1: Regional Fault Lines**



Imagery provided by Microsoft Bing and its licensors © 2021.  
Additional data provided by USGS, 2020.

Figure 2: Ground Shaking Intensity



Imagery provided by Microsoft Bing and its licensors © 2021.  
Additional data provided by Metropolitan Transportation Commission, 2021

Fig. 2

high-risk of liquefaction, in the event of a significant earthquake. Most of the high-risk areas follow along the railroad corridor, which is similar to the Petaluma River's general location as it flows from the northwest of the City, through the center and downtown area, then out through the center-east (see **Figure 3**). For more information on liquefaction potential in the City of Petaluma refer to the LHMP, 2020.

### Landslides and Erosion

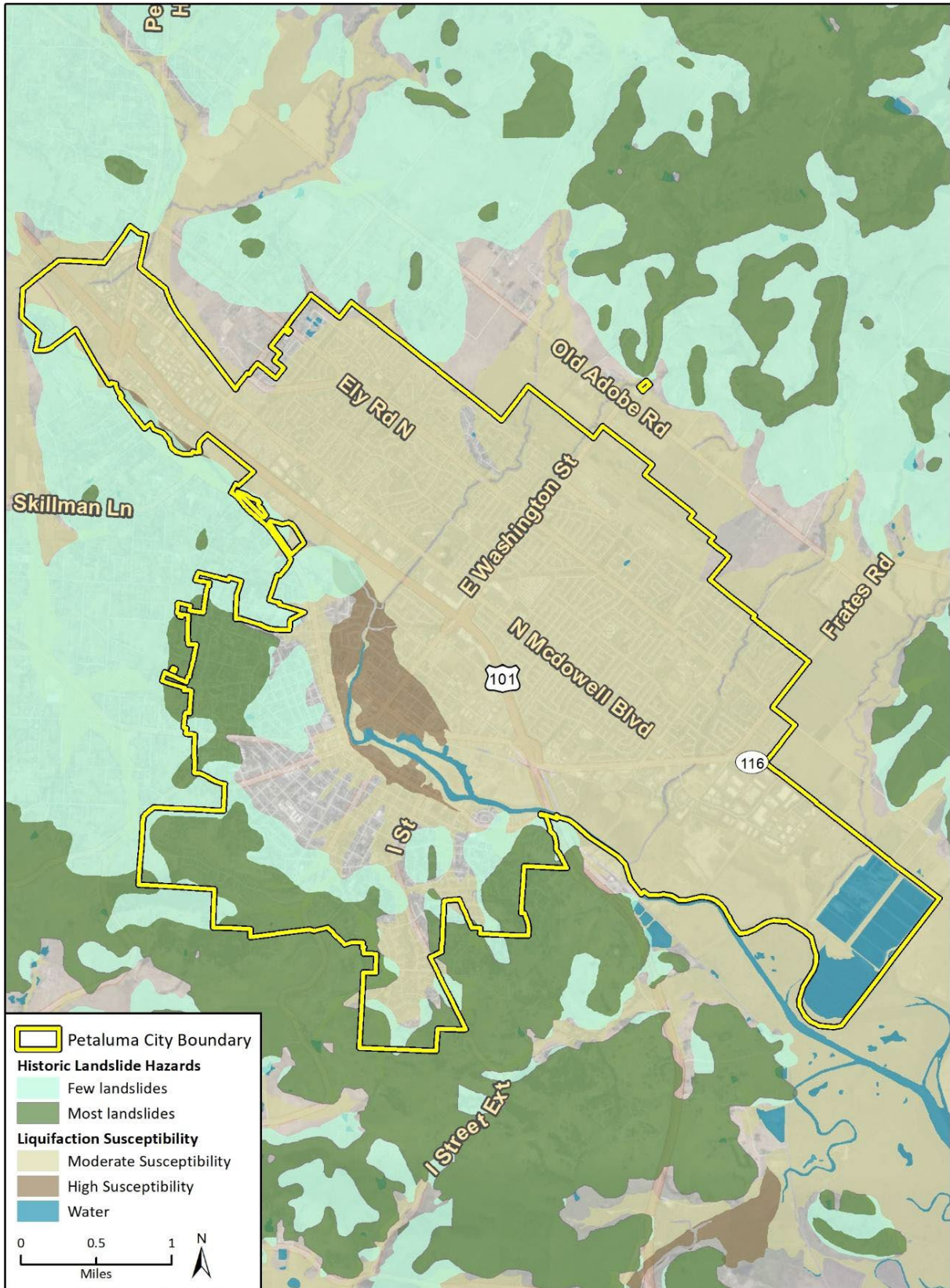
A landslide is a geologic hazard where the force of gravity combines with other factors to cause earth material to move or slide down an incline. The California Geological Survey (CGS) along with the California Department of Conservation have generated a landslide dataset that classifies susceptibility in California to various degrees, from Very High (the most potentially dangerous) to a none or dry category (the least risk). The majority of Petaluma is in the lower risk categories of landslides, meaning that the local soils and geology are not very likely to lead to landslide activity. However, some higher landslide susceptibility areas fall inside the city boundary. In **Figure 3** below the historical locations of landslide occurrence and landslide susceptibility are illustrated. A majority of the city is included in the moderate susceptibility category and small portions in the western and southern parts of the city are in High susceptibility. Historically, landslides have occurred in the hills to the northeast and southeast of the city. During heavy rainfall events, added precipitation in soil can result in increased landslide potential and susceptibility in these higher-risk areas. Erosion along the Petaluma River will also become more of a threat as a result of sea level rise as a result of climate change, combined with storm surges.

### Flood Hazards and Flood Zones

Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss. Flooding is usually the result of, or is exacerbated by, weather events, and can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. The City is susceptible to various types of flooding including riverine, localized flooding resulting from heavy precipitation in a short span of time, and dam failure.

Flooding caused by heavy rainfall, primarily associated with seasonal storms, can occur in the region during winter and spring months. In the more urbanized areas of Petaluma, localized flooding intensifies because of impervious surfaces such as roads and paved structures that prevent the natural absorption of rainfall and runoff. According to the latest FEMA National Flood Hazard data, the 100- and 500- year flood plains are located on the south-southeast and north-northwest of the city and along the Petaluma River (See **Figure 4**). The most frequent flooding occurs along the Petaluma River, and the City has created the Petaluma River Flood Mitigation Plan to address the issues of reoccurring flooding during heavy rains. Other smaller areas susceptible to flooding occur along Lakeville Highway and Casa Grande Road, where Adobe Creek and the Petaluma River meet, as well as east of Washington Street and McDowell Boulevard, where Lynch Creek converges with nearby tributaries associated with the Petaluma

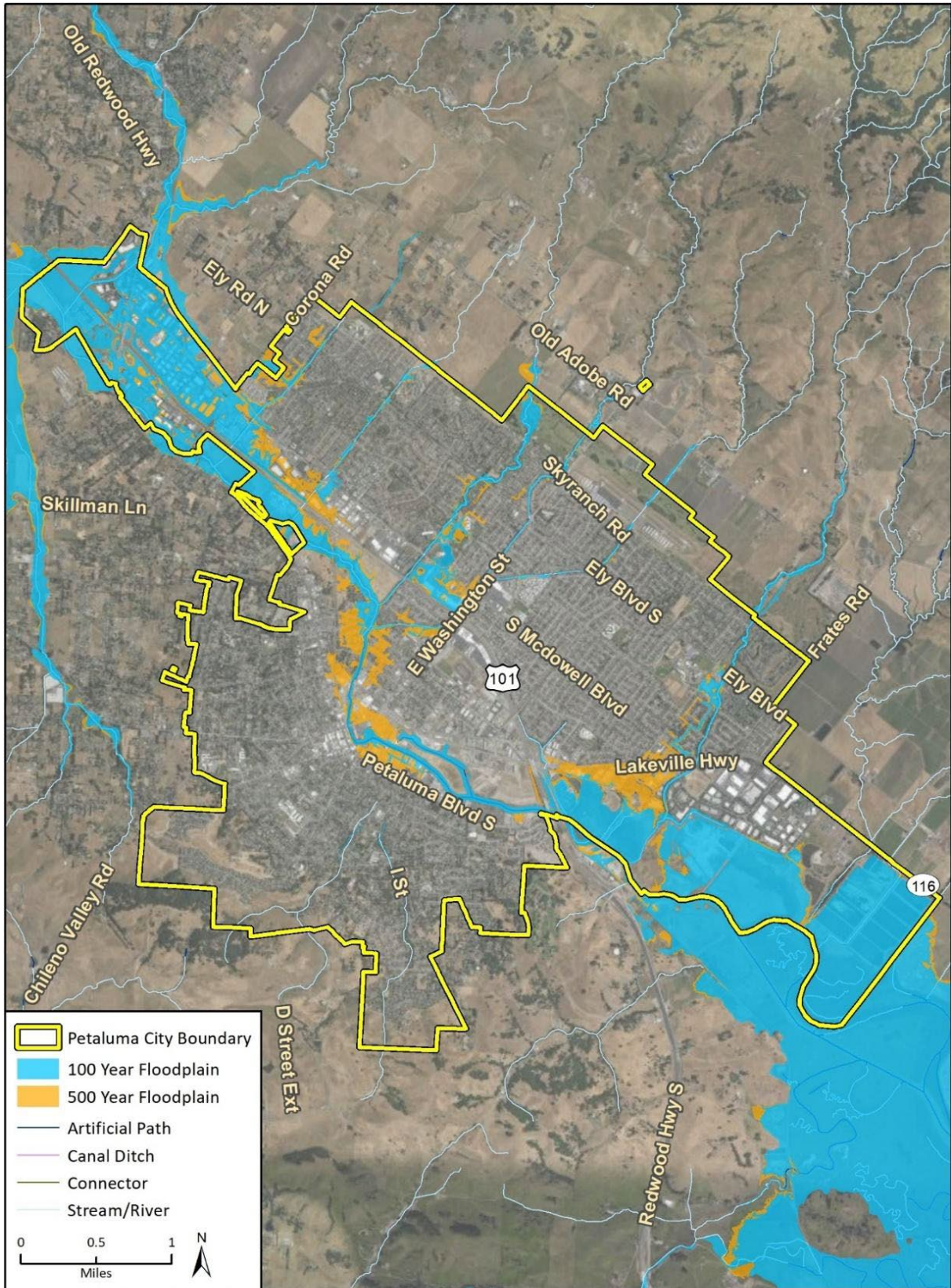
**Figure 3: Geologic Hazards**



Imagery provided by Microsoft Bing and its licensors © 2021.  
Additional data provided by USGS, 2021.

Fig 3(N) Geologic Hazards

**Figure 4: FEMA Flood Zones**



Imagery provided by Microsoft Bing and its licensors © 2021.  
Additional data provided by FEMA, 2020 and USGS, 2020.

Fig. W12-113M Flood Hazard Zones in Petaluma

River. The more upstream portions of Lynch Creek, near the north-northeast of the city, are also affected by flooding, towards Adobe Road north of Sonoma Mountain Parkway.

The Payran neighborhood and adjacent areas are the most severely impacted by historic flooding. Previous significant floods include those of 1982 and 2005, which resulted in millions of dollars in damage and losses, and more recent flooding has occurred caused by heavy rains falling in a short period of time. In 2019, heavy rains flooded a section of Industrial Avenue, which delayed traffic and caused minor damage but is indicative of more frequent similar events as climate change causes more concentrated heavy rainfall.

The City of Petaluma owns, operates, and maintains two floodwalls within its planning area. The two structures are located west of Washington Street along the Petaluma River, in the center-west portion of the city. The Payran neighborhood previously suffered from frequent flooding related to the Petaluma River. The neighborhood was once considered in the 100-year flood plain under FEMA. The recent completion of the Payran Flood Control Project by the Army Corps of Engineers has resolved a majority of the flood concerns for the Payran neighborhood area. The risk of inundation from the river is now very low and the neighborhood is no longer classified within a flood-plain.

Should a dam or levee breach occur, severe flooding is possible. According to the U.S. Army Corps of Engineers' National Inventory of Dams database, last updated in 2018, there are three potential dams of concern upstream of the City of Petaluma. These and other nearby dams may have been constructed for flood control, irrigation storage, recreation, and stock watering purposes. Two dams in the area are at risk of failure according to Army Corps of Engineers: the Pinheiro Dam and the La Crema Winery Dam. However, the Petaluma LHMP analyzes the risk of inundation from dam failure and finds that the risk of inundation is very low as the area of concern is minimal.

## Wildfire Hazard

Wildfires are a significant concern throughout California, typically caused by lightning or human activities such as arson or accidents involving cigarettes, fireworks, campfires, equipment misuse, or electrical infrastructure. Generally, the fire season extends from June through October of each year during the hot, dry months. Fire conditions arise from a combination of high temperatures, intense heat, low rainfall, an accumulation of fuel vegetation, and high winds. In recent years, hundreds of thousands of buildings have been destroyed by wildfire, thousands of people have been displaced, and dozens left dead. In addition, wildfires in surrounding areas, even a few counties away, can create impacts to the city such as intense smoke, which can lead to poor air quality, traffic visibility issues, and public health concerns. The 2020 fire season was the most extreme in California's recorded history. With multiple fires burning in the region, air quality was poor for weeks. While much of the surrounding area are moderate to high fire hazard, there are several areas in the southern portion of the city that are considered very high fire hazard.

Petaluma has experienced several notable wildfire events dating back to 1900 and earlier. The rugged terrain, dry vegetation and the rocky slopes of the surrounding lands all contribute to wildfire potential. In the Fall of 2017, the Santa Rosa fires spread and affected the Fountaingrove and Coffey Park areas extensively, with high winds and dry conditions fueling the flames. The fire seasons of 2017 and 2020 were especially devastating to the region. The Kincade Fire in October 2019 burned 77,758 acres and over 90,000 structures. In 2020 the LNU Complex Fires became the biggest in Sonoma County history and burned for two months. The multiple fires resulted from an unusually dry thunderstorm, burning 363,220 acres and destroying 1,491 structures. Residents and wildlife were exposed to poor air quality for



## Natural Hazards

weeks, and surface water sources were polluted by the falling smoke and ash. Not only are these fires devastating, the city's emergency response services and programs can be stressed beyond capacity.

Petaluma will see a continuation of the risk of wildfire in the coming decades as climate change exacerbates wildfire conditions. While much of the city is in the Moderate Fire Hazard Severity Zone, the pattern in the overall region suggests that fires will increase everywhere, or that indirect impacts of fires such as community exposure to poor air quality and smoke will be more severe. **Figure 5** illustrates the areas that are currently in the moderate and high fire hazards areas for wildfire. This figure includes the State Responsibility Area (SRA) and Local Responsibility Area (LRA) to illustrate the fire hazard areas each are responsible for.

## Wildland Urban Interface (WUI)

When urban development encroaches on wildlands and other natural areas, this is known as the Wildland Urban Interface (WUI). The area considered the WUI is known to be of greater risk of wildfire due to how easy wildfire travels from the natural area to buildings in the WUI. The LHMP further discusses fire risk and creates the framework for a WUI pre-fire plan for those areas in the WUI. **Figure 6** illustrates the areas of Petaluma that are located within WUI Fire Risk zones. The most at risk areas exist along the perimeter of the city boundary where development is adjacent to or interspersed in areas with wildland vegetation present. In **Figure 6** below there are three zones for illustrating the WUI risks for the City of Petaluma:

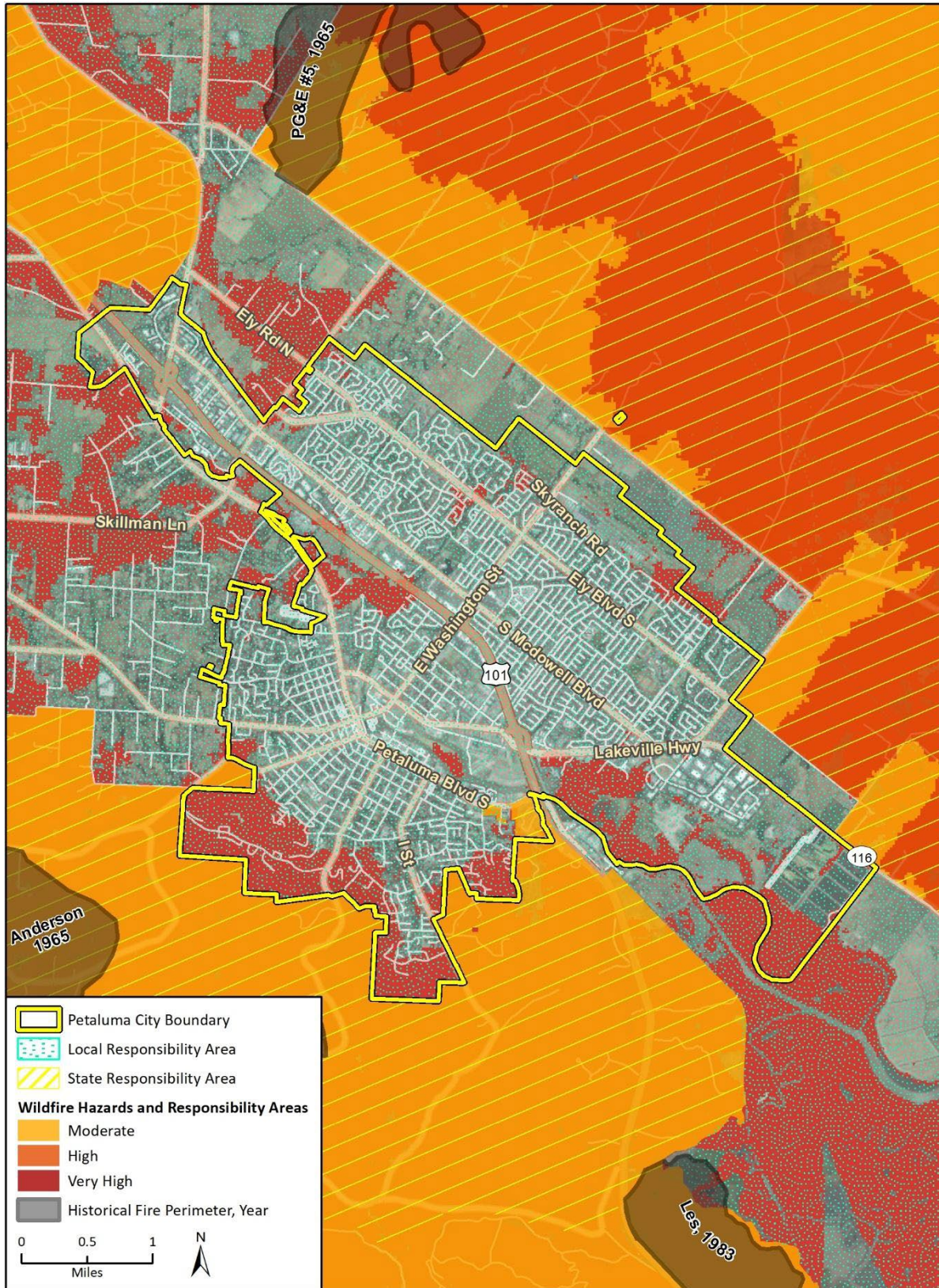
- Influence Zone: Wildfire susceptible vegetation up to 1.5 miles from the Wildland Urban Interface or Wildland Urban Intermix
- Interface: Dense housing adjacent to vegetation that can burn in a wildfire
- Intermix: Housing development interspersed in an area dominated by wildland vegetation subject to wildfire

These three zones encompass the WUI for the city. **Figure 6** shows there are several areas with residential uses adjacent to wildfire prone vegetation, including a portion of central Petaluma between Highway 101 and Petaluma Boulevard North, land to the south of Lakeville Highway near the Rocky Memorial Dog Park, land adjacent to the intersection of Casa Grande Road and Hidden Valley Drive, and a large stretch of the city boundary in southern and western Petaluma. The remaining WUI illustration includes the intermix zone, which includes housing developments interspersed among wildfire-prone vegetation.

## Fire Protection Resources

The Petaluma Building Code (Title 17) was updated to include regulations from the 2019 California Fire Code (Title 24, Part 9 of the California Building Standards). The City's updated code includes building safety guidelines to reduce fire risk and outlines the role of the Fire Department and Fire Chief in implementing regulations. The Petaluma Fire Department provides fire protection services to a total area of 184 square miles and a population of 70,000 people. The Department's fire service area includes

**Figure 5: High Fire Hazard Areas**

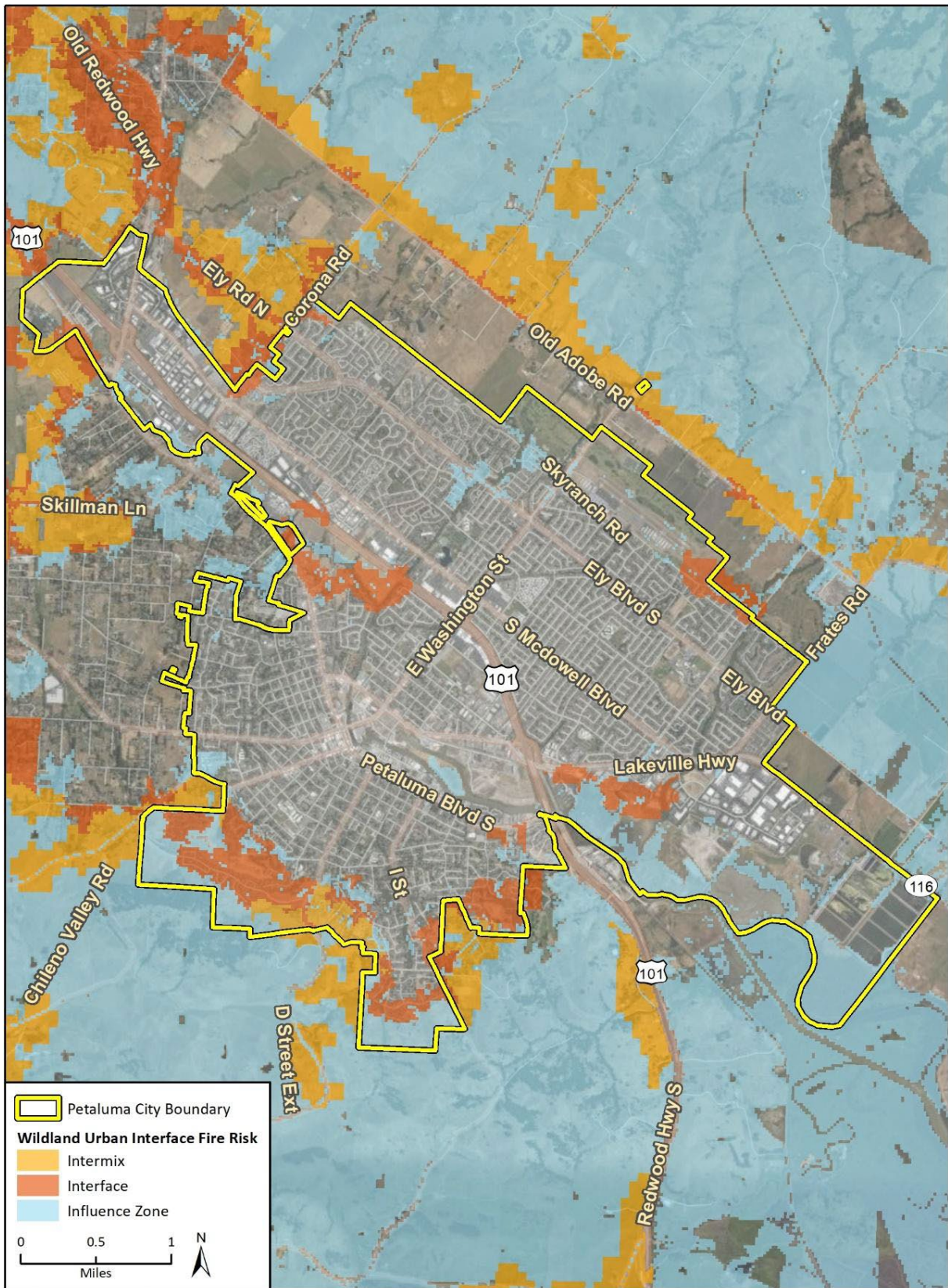


Imagery provided by Microsoft Bing and its licensors © 2021.

Additional data provided by CalFire, 2021; Wildfire Severity Hazard Class - City of Petaluma, California. Fire Responsibility Area, Historic Fire

Fig N14 High Fire Hazard Zones and SRA, Final

**Figure 6: Wildland Urban Interface Fire Risk Map**



portions of southern Sonoma County and Marin County. There are three Fire Department Stations located within the city limits and two volunteer fire stations are located southwest of the city. The Department has 58 personnel, with 48 divided among three platoons that work in 24-hour rotating shifts. In response to wildfires, the Fire Department offers several resources to residents such as weed abatement and access to wildfire disaster loans. As of 2019, the Petaluma Fire Department has an Insurance Service Office (ISO) rating of 3 and adopted the most recent Emergency Operations Plan in 2007.